REMARKS

Claims 1, 3 – 10 and 12 – 26 are now pending in the application. The Examiner is respectfully requested to reconsider and withdraw the rejections in view of the amendments and remarks contained herein.

REJECTION UNDER 35 U.S.C. § 102

Claims 1, 3 – 10 and 12 – 26 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Lentz (U.S. Pat. No. 5,216,606). This rejection is respectfully traversed.

Claims 1, 10 and 20, as amended herein, include an apparatus and method of controlling cooling of a friction device. More specifically, a temperature state is estimated based on an estimated heat rate of the friction device and a cooling flow command is calculated based on the temperature state. Lentz fails to teach or suggest regulating cooling of a friction device based on an estimate temperature state, which is based on an estimated heat rate of the friction device.

As discussed in detail in the response filed on March 21, 2006, the present invention provides friction device cooling control. The cooling control of the present invention uses an estimated heat generation rate to estimate, as opposed to physically measure, a temperature state of the friction device. In this manner, the control system is simpler, faster-acting and more robust than traditional systems. Further, the model-based approach of the present invention directly comprehends the critical interface temperature limit, thereby eliminating guesswork and destructive trials-and-errors of a sensor-based system.

At the outset, it is important that the disclosure of Lentz is properly characterized. Lentz discloses a compensated control method for actuating an on-coming clutch in an automatic transmission. Contrary to the Examiner's assertion that "[i]t is well known that hydraulic [fluid] is used as an actuating/cooling fluid" (see Final Office Action, Page 8, Point 5) and that "[i]t is believed that it is well known for hydraulic fluid to act as a cooling fluid while actuating the clutch" (emphasis added) (see Final Office Action, Page 9, continuation of Point 5), Lentz is completely silent as to cooling of a friction device. The Examiner's assertions attempt to cure the deficient disclosure of Lentz, suggesting that cooling of a friction device is indeed not disclosed in Lentz. Accordingly, the Examiner has implicitly acknowledged that Lentz fails to teach each and every element of claims 1, 10 and 20.

With specific consideration to the Examiner's assertion that "[i]t is believed that it is well known for hydraulic fluid to act as a cooling fluid while actuating the clutch" (emphasis added), it is respectively asserted that it is not well known for hydraulic fluid to act as a cooling fluid while actuating the clutch. More specifically, the actuating fluid flow required to actuate the clutch is wholly independent of the coolant fluid flow required to cool the clutch. The actuating fluid flow is commanded to control the engagement of the clutch to a specific degree, and does not concurrently cool the clutch components.

For example, when the clutch is fully engaged, the actuating fluid flow command is at its maximum value. Because there is no relative slip between the clutch components, no heat is generated and the cooling flow command is at its minimum. When the clutch is partially engaged, the actuating fluid flow command is less than its

maximum. Because there is slip across the clutch components, heat is generated and the cooling flow command is at its maximum. Accordingly, the Examiner's assertion is not supported by Lentz and is both inaccurate and misleading.

Lentz determines a clutch fill time (T_{FILL}), which is the time required to fill the clutch with hydraulic fluid to initiate engagement of the clutch (Col. 4, Lines 44 – 45). A pump is driven by the engine to provide pressurized hydraulic fluid to the torque converter clutch (TCC) and the clutches C1 – C5, and the pump efficiency is determined based on the temperature of the hydraulic fluid (Col. 3, Lines 32 – 41). The pump speed is adjusted based on the pump efficiency (Col. 6, Lines 1 – 18).

Accordingly, Lentz is directed toward accounting for temperature changes in the hydraulic fluid used to actuate the friction device to enable the torque transfer through the friction device to be accurately regulated, regardless of the temperature of the hydraulic actuating fluid. The Lentz does not describe improved heat protection for the friction device. Further, Lentz is limited to actually measuring a fluid temperature to adjust a pump speed and fails to teach or suggest estimating a friction device temperature or estimating a heat rate of the friction device.

In view of the foregoing, each of claims 1, 10 and 20 define over the prior art and reconsideration and withdrawal of the rejections are respectfully requested.

Claims 3 – 9, 12 – 19 and 21 – 26 each ultimately depend from one of claims 1, 10 and 20, which define over the prior art, as discussed in detail above. Therefore, claims 3 – 9, 12 – 19 and 21 – 26 also define over the prior art for at least the reason stated with respect to claims 1, 10 and 20, and reconsideration and withdrawal of the rejections are respectfully requested.

Claims 1, 3 – 10 and 12 – 26 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Buchanan (U.S. Pat. No. 6,715,597). This rejection is respectfully traversed.

Claims 1, 10 and 20, as amended herein, include an apparatus and method of controlling cooling of a friction device. More specifically, a temperature state is estimated based on an estimated heat rate of the friction device and a cooling flow command is calculated based on the temperature state. Buchanan fails to teach or suggest regulating cooling of a friction device based on an estimate temperature state, which is based on an estimated heat rate of the friction device.

As discussed in detail in the previously filed responses, which are incorporated herein by reference, Buchanan discloses a method of controlling clutches in a dual clutch transmission. The method of Buchanan is executed using a reactionary system that determines bulk clutch temperature change based on a measured fluid temperature. As a result, Buchanan does not account for the delay between heat generation and temperature measurement, which can result in clutch and/or fluid damage before adequate fluid flow is provided. More specifically, within the time between the fluid leaving the clutch and measuring the fluid temperature, the clutch temperature can significantly increase and clutch damage can occur.

Furthermore, Buchanan requires two temperature sensors, one to monitor the sump temperature and another to monitor the temperature of the fluid exiting the friction device (i.e., a temperature sensor that is associated with the friction device) (see 242 of Figure 3A). Accordingly, Buchanan provides an excellent example of an overly

complicated and more expensive system, which is directly opposite to that provided by the present invention.

In view of the foregoing, Buchanan fails to teach or suggest estimating a clutch temperature based on an estimated heat rate and further fail to teach or suggest a cooling flow command that is calculated based on the temperature state and that is not based on a signal from a temperature sensor associated with the friction device. Accordingly, claims 1, 10 and 20 define over Buchanan and reconsideration and withdrawal of the rejections are respectfully requested.

Claims 3 – 9, 12 – 19 and 21 – 26 each ultimately depend from one of claims 1, 10 and 20, which define over the prior art, as discussed in detail above. Therefore, claims 3 – 9, 12 – 19 and 21 – 26 also define over the prior art for at least the reason stated with respect to claims 1, 10 and 20, and reconsideration and withdrawal of the rejections are respectfully requested.

OTHER CLAIM AMENDMENTS

Each of claims 5, 6, 14 – 17, 23 and 24 have been amended to provide a "cooling flow command", in view of the amended claims 1, 10 and 20.

CONCLUSION

It is believed that all of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. Applicant therefore respectfully requests that the Examiner reconsider and withdraw all presently outstanding rejections. It is believed that a full and complete response has been made to the outstanding Office Action, and as such, the present application is in condition for allowance. Thus, prompt and favorable consideration of this amendment is respectfully requested. If the Examiner believes that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned at (248) 641-1600.

Respectfully submitted,

Dated: August 1, 2006 By: _____

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